

THE *PROVENZANOI* GROUP OF HERMIT CRABS  
(CRUSTACEA, DECAPODA, PAGURIDAE)  
IN THE WESTERN ATLANTIC

PART I. *PAGURUS MACLAUGHLINAE*, A NEW SPECIES

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ABSTRACT

In this first part of a four-part series, an abundant and widely distributed new species, previously misidentified or confounded with *Pagurus annulipes* (Stimpson) and *Pagurus bonairensis* Schmitt, is described and illustrated. Its relationship with *P. bonairensis* is discussed.

The genus *Pagurus* presently contains more than 150 species worldwide, and is recognized to be of great heterogeneity. In lieu of a major revision of this exceptionally large genus at the present time, carcinologists have proposed informal groups (Forest and De Saint Laurent, 1968; McLaughlin, 1974). These groups have been designated by Roman numerals and names reflecting typical species of each group. Group I, the *Provenzano*i group, has been defined by McLaughlin (1975) to include eight western Atlantic species: *Pagurus annulipes* (Stimpson, 1860); *P. bonairensis* Schmitt, 1936; *P. brevidactylus* (Stimpson, 1858); *P. carolinensis* McLaughlin, 1975; *P. hendersoni* Wass, 1963; *P. marshi* Benedict, 1901; *P. provenzano*i Forest and De Saint Laurent, 1968; and (?) *P. stimpsoni* (A. Milne Edwards and Bouvier, 1893). Although the characters of this group have been clearly defined, the identities and geographical distributions of some of the species have remained unclear. This is particularly true of *Pagurus macLaughlinae* n. sp., described herein, which for many years has been misidentified as *P. annulipes* or confounded with another species under the name of *P. bonairensis*.

MATERIALS AND METHODS

Specimens included in this study have come primarily from ecological studies conducted by researchers at the Rosenstiel School of Marine and Atmospheric Science, University of Miami (RSMAS). Supplemental materials have been obtained from the American Museum of Natural History (AMNH); Brevard County Health Department (BHD); National Museum of Natural History, Smithsonian Institution (USNM); and the University of Southwestern Louisiana (USWL). Specimens have been returned to contributors or deposited in the collections of the National Museum of Natural History and the Rosenstiel School of Marine and Atmospheric Science. One measurement, the shield length (SL), has been made for each specimen using either an ocular micrometer or vernier calipers. All measurements have been made to the nearest 0.1 millimeter.

*Pagurus macLaughlinae* new species

Figures 1, 2

- ? *Eupagurus annulipes*: Ives, 1891: 193 [not *Eupagurus annulipes* Stimpson].  
*Pagurus annulipes*: Schmitt, 1935: 205 (in part).—Provenzano, 1959: 407, fig. 18.—Tabb and Manning, 1961: 599 [not *Pagurus annulipes* (Stimpson)].—Williams, 1965: 130 (in part), fig. 105.—Forest and De Saint Laurent, 1968: 127 (in part) [see remarks].  
*Pagurus bonairensis*: Hazlett and Bossert, 1966: 546.—Iversen and Roessler, 1969: 1.—Rouse, 1970: 142.—Felder, 1973: 26 (in part), fig. 5.—Grizzle, 1974: 135 [not *Pagurus bonairensis* Schmitt].

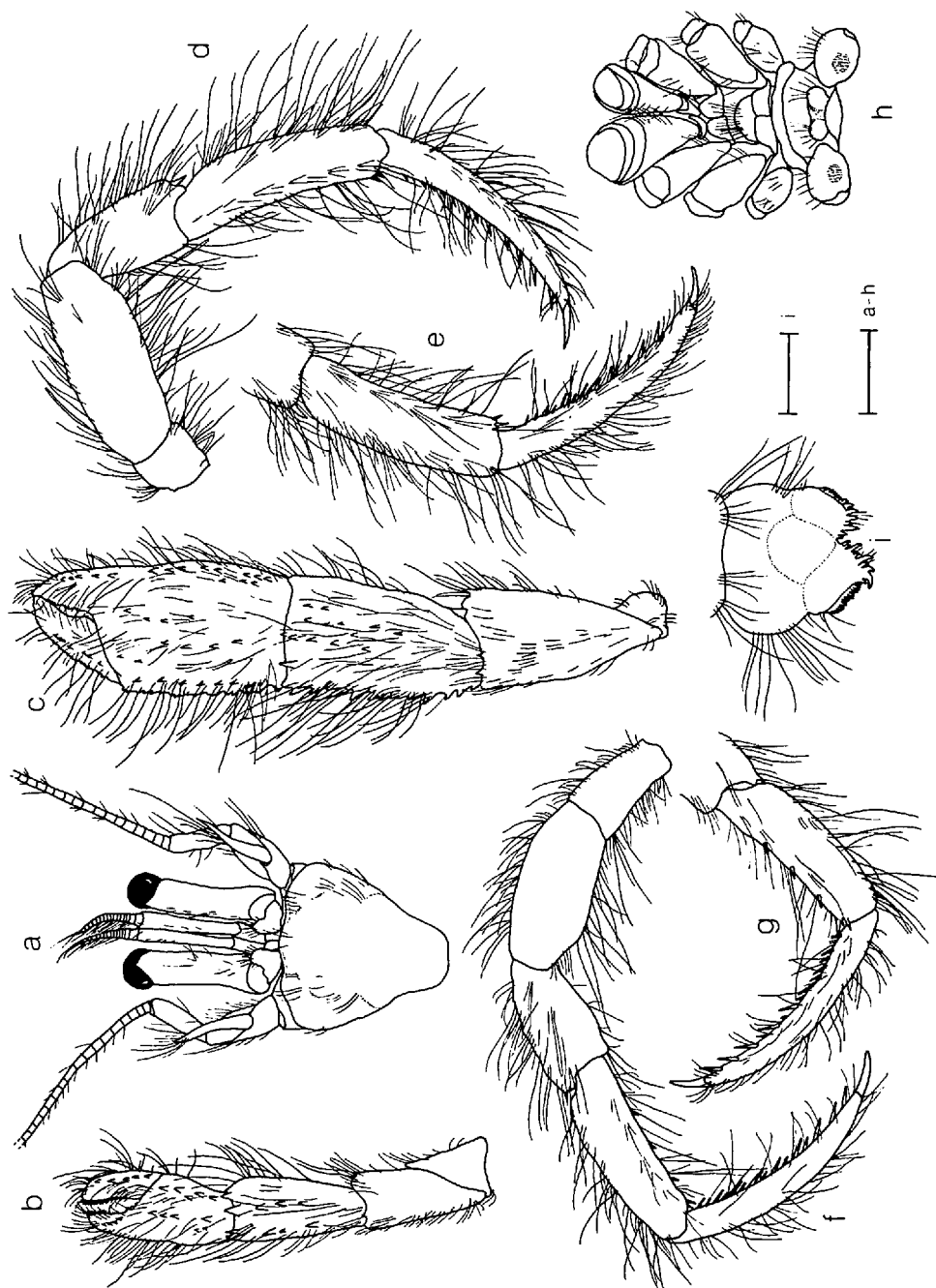


Figure 1. *Pagurus macLaughlinae* new species: a, Shield and cephalic appendages; b, Left cheliped; c, Right cheliped; d, 2nd right pereopod (lateral view); e, Propodus and dactyl of 2nd right pereopod (mesial view); f, 3rd left pereopod (lateral view); g, Propodus and dactyl of 3rd left pereopod (mesial view); h, Thorax (ventral view); i, Telson. Scales equal 1 mm (a-h) and 0.5 mm (i).

? *Pagurus bonairensis*: Voss et al., 1969: 77.—Hudson et al., 1970: 9.—Roessler et al., 1971: 109.—Bader and Roessler, 1971: V-24.—Roessler et al., 1972: V-6.—Tabb et al., 1972: 7.—Tabb et al., 1974: 30.—Roessler and Tabb, 1974: 62.—Roessler et al., 1975: 32.—Hooks et al., 1976: 101 [? not *Pagurus bonairensis* Schmitt; see remarks].  
*Pagurus* n. sp.: Thorhaug et al., 1978: 540.

*Holotype*.—♂ (SL = 2.4 mm), USNM 184216; type locality: Wading Beach, Matheson Hammock, Miami, Florida.

*Material Examined*.—See Table 1.

*Description*.—Shield approximately as long as broad, occasionally slightly longer; anterolateral margins sloping; anterior margins between rostrum and lateral projections slightly concave; posterior margin roundly truncate; dorsal surface with few tufts of short setae. Rostrum rounded, reaching or slightly exceeding lateral projections, unarmed, but with tufts of moderately long setae. Lateral projections rounded or obtusely triangular, unarmed.

Ocular peduncles moderately long, three-fourths to five-sixths length of shield, moderately slender, somewhat inflated basally, and with corneae slightly dilated; dorsomesial face with longitudinal row of moderately long setae, mesial surface with median tuft of stiff setae. Ocular acicles rounded, terminating subacutely, with submarginal spine and tufts of moderately short setae; separated basally by basal width or less of 1 acicle.

Antennular peduncles moderately long, exceeding ocular peduncles by one-half to three-fourths length of ultimate segment. Ultimate and penultimate segments each usually with few short setae on dorsal and ventral margins; basal segment unarmed, but with tufts of moderately long setae on lateral and mesial margins.

Antennal peduncles moderately short, slightly less than or equaling length of ocular peduncles; with supernumerary segmentation. Fifth segment with dorsal surface and ventral margin each with row of tufts of moderately long setae. Fourth segment with moderately long setae on mesial and lateral margins distally. Third segment with spinule and moderately long setae on ventrodistal margin; lateral face and ventral margin each with moderately long setae. Second segment with dorsolateral distal angle produced, terminating in strong, acute simple, bi- or trifid spine, usually obscured by numerous long setae; dorsomesial distal angle with spinule and moderately long setae; ventromesial margin with moderately long setae. First segment usually with small spine on laterodistal margin; ventromesial margin produced, usually with small spine laterally. Antennal acicles moderately short, usually not exceeding proximal third of ultimate segment; terminating in strong acute spine, encircled by long setae; dorsomesial margin often with long setae. Antennal flagella usually not overreaching right cheliped; each article with 1–6 setae varying from less than 1 to 3 articles in length, often alternating short and long in different sequences.

Mandible without distinguishing characters. Maxillule with proximal endite usually tapered; endopod with 1 long bristle on weakly developed internal lobe, external lobe well developed, not recurved. Maxilla with endopod slightly inflated basally, exceeding scaphognathite in distal extension. First maxilliped with endopod approximately one-half length of exopod; basal segment of exopod inflated proximally, narrowing abruptly distally. Exopods of 2nd and 3rd maxillipeds with strong setae used for coupling in resting position. Third maxilliped with basis usually armed with 1 strong spine; ischium with crista dentata well developed, 1 accessory tooth; merus and carpus unarmed. Sternite of 3rd maxillipeds unarmed, midline produced and provided with row of long setae.

Chelipeds dissimilar, right larger than left, particularly in large males. Right cheliped with dactyl varying in length from moderately long, equaling or slightly

Table 1. *Pagurus macLaughlinae* new species (material examined)

Locality	Depth (m)	Station Deposition	Date	Sex		SL (mm)	Collector
				♂	♀		
Gulf of Mexico							
Chandeleve I., LA		— USWL	6/3/79	20	9	1.5–2.5	Felder
Crystal River, FL	0.9	— RSMAS	6/2/80	4	3	3.6–5.6	Gleman
Crystal River, FL	1.2	— RSMAS	9/16/80	1		1.2	Hieber
Fakahatchee Bay, FL		10-F1-7 RSMAS	3/–/72	1	1	2.2, 2.3	Yokel
Estero Bay, Fl		T-23 RSMAS	10/–/72	6	3	0.9–1.9	Berkeley
Oyster Bay, FL		67 RSMAS	12/79–1/80	3		0.6–1.7	Brook
Ponce de Leon Bay, FL		67 RSMAS	8/23/79	1	1	2.0, 2.3	Brook
Whitewater Bay, FL		60, 65 RSMAS	5/79, 1/80	4	1	2.0–2.1	Brook
Bottonwood Sound, FL	2.0	B1, B2, B3 USNM 184217	4/6/77	1	2	2.2–2.7	Teas
Western Atlantic							
Banana River, FL		RG71-13 BHD	7/14/70	1	4	1.9–2.3	Grizzle
Indian River, FL		RG71-19, 21 BHD	8/2, 5/71	5	2	1.9–2.5	Grizzle
Lake Worth, FL	1–5	13-1; 9-2 RSMAS	5/10/74	7	4	0.6–2.3	Beardsley, García-Gómez
Fisherman's I., FL	2.0	— RSMAS	5/30/74	1		1.6	Beardsley, García-Gómez
Biscayne Bay, FL Bear Cut	1.2	— RSMAS	5/30/80	3	8	1.1–1.9	García-Gómez
Matheson Ham- mock	1.3	— USNM 184216	9/20/80	1		2.4	García-Gómez
Moody Canal	1.0	— RSMAS	3/14/79	1	1	2.2, 2.4	Brook
Mowry Canal	1.8	— RSMAS	5/79, 1/80	5	7	1.8–2.7	Brook
Grand Canal	1.7–2.0	— RSMAS	7/79, 1/80	9	5	1.6–2.4	Brook
Mangrove Key	1.0	— RSMAS	10/12/79	6	4	1.5–2.7	Brook
Card Sound, FL	0.3–3.0	1–4 RSMAS	1975–77	7	4	0.7–3.2	Brook
Caribbean							
Puerto Rico		— AMNH	6/12/15	2		2.1, 3.4	Schmitt

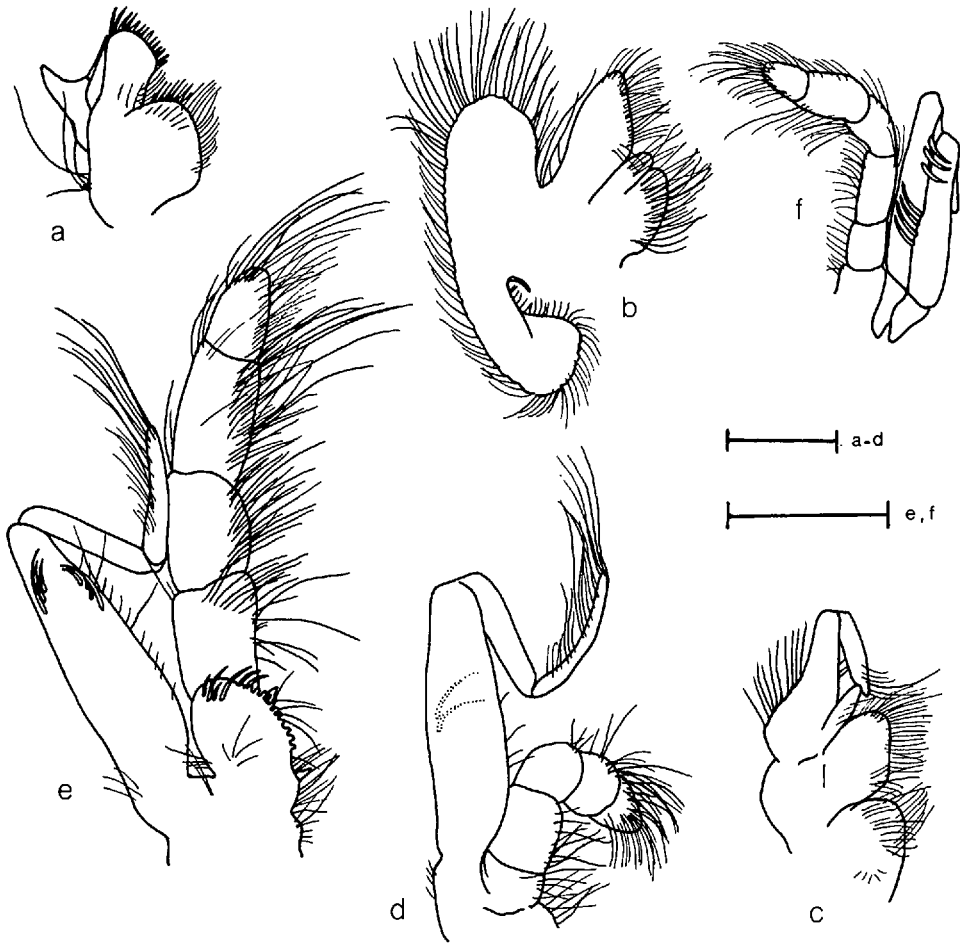


Figure 2. *Pagurus macLaughlinae* new species, mouthparts (left, internal view): a, Maxillule; b, Maxilla; c, 1st maxilliped; d, 2nd maxilliped; e, 3rd maxilliped; f, Coupled 2nd and 3rd maxillipeds. Scales equal 0.5 mm (a–d) and 1.0 mm (e, f).

exceeding length of palm (females) to moderately short, approximately three-fourths length of palm (males); cutting edge with 1 or 2 moderately prominent calcareous teeth proximally and corneous teeth distally; males usually with moderate interdigital hiatus; terminating in small corneous claw, usually overlapped by fixed finger; dorsomesial margin with irregular row of spinulose tubercles (large males) or sparse row of moderately small spines or tubercles (females and small males); dorsal surface with irregular median row or double row, converging distally, of spinulose tubercles; ventromesial margin with irregular row of spinulose tubercles (large males) or small tubercles (females and small males); ventrolateral margin with row of spinulose tubercles in large males; all surfaces with tufts of short to moderately long setae. Palm varying in length from moderately short (approximately three-fourths length of carpus in females and small males) to moderately long (equaling or exceeding length of carpus in large males); subrectangular (males) or subquadrate (females); dorsomesial margin with single or

double row of spines or spinulose tubercles, dorsal surface slightly convex, and armed with several irregular rows of strong spines (females and small males) or sparse irregular rows of small spines or tubercles (large males); dorsolateral margin with row of moderately small spines interspersed with spinules (large males) or moderately strong spines (females and small males); lateral, mesial and ventral surfaces often somewhat tuberculate; all surfaces with few to numerous short to long setae. Carpus moderately long, somewhat longer than merus; slightly inflated ventrally, in females often exceeding depth of palm; dorsomesial margin with irregular single or double row of moderately strong acute spines, dorsal surface with scattered small spines; lateral face often tuberculate, distal margin with 1 or 2 strong acute spines ventrally; ventral surface and mesial face often somewhat tuberculate; all surfaces usually with moderately long setae. Merus subtriangular; dorsal margin with irregular row of low protuberances and tufts of moderately long setae, dorsodistal margin with row of small spines and tufts of moderately long setae; ventromesial and ventrolateral margins each with row of spinulose tubercles or small acute spines, usually stronger in large males. Ischium with row of moderately short setae on ventral margin. Coxa with tufts of long setae on ventromesial distal angle and moderately long setae on ventromesial margin.

Left cheliped usually short, reaching to palm of right proximally. Dactyl moderately long, usually exceeding length of palm; terminating in small corneous claw, usually overlapped by fixed finger; cutting edge with row of corneous teeth, and with narrow interdigital hiatus, usually more prominent in males; dorsomesial margin with row of small spines, diminishing in size distally; all surfaces with numerous tufts of moderately long setae. Palm one-half to two-thirds length of carpus; triangular in cross-section, with midline somewhat elevated; dorsolateral margin with or without row of small, well-spaced spines; midline with single or double row of strong spines proximally, extending onto fixed finger as single row of smaller spines; dorsomesial margin with irregular row of strong spines; all surfaces with tufts of setae. Carpus moderately long, equaling or slightly less than length of merus; slightly inflated ventrally; dorsolateral and dorsomesial margins each with row of strong or moderately strong spines, distal margin with 1-3 strong acute spines; mesial and lateral faces usually somewhat tuberculate, distolateral margin with 1 or 2 spines ventrally; all surfaces with numerous tufts of moderately long setae. Merus subtriangular; dorsal margin with irregular row of low protuberances and tufts of moderately long setae; dorsodistal margin with row of small spines and tufts of moderately long setae; ventromesial and ventrolateral margins each with row of spinulose tubercles or small spines, frequently stronger in large males. Ischium with row of moderately short setae on ventral margin, also row of spinules in large males. Coxa smaller than that of right, particularly in large males, and provided with tufts of long setae on ventromesial distal angle, shorter on ventromesial margin.

Ambulatory legs moderately short, slightly overreaching right cheliped; generally similar from right to left. Dactyls moderately short, one-fourth to one-third longer than propodi; in lateral view, curved ventrally; in dorsal view, usually straight; terminating in strong, curved corneous claw; dorsal surfaces each with row of tufts of moderately long or long setae; lateral and mesial faces usually with few scattered setae; ventral margins each with row of strong corneous spines, increasing in size distally, interspersed with smaller corneous spinules proximally, and with row of tufts of moderately long setae. Propodi moderately long, exceeding length of carpi of one-fourth to one-third own length; dorsal surfaces each with numerous tufts of long setae; lateral and mesial faces each with tufts of moderately long setae near dorsal and ventral margins; ventromesial

margin of 3rd pereopods with row of widely-spaced small corneous spines, ventromesial distal angle of 2nd pereopods with 1–3 small corneous spines. Carpi moderately long, approximately three-fourths length of meri; dorsal surfaces each with numerous tufts of long setae, distal margins each with moderately strong spine; ventral, lateral, and mesial surfaces frequently with few scattered setae. Meri with numerous tufts of moderately long or long setae; 2nd pereopods each with moderately strong spine at ventrolateral distal angle. Ischia each with rows of setae on dorsal and ventral margins. Coxae each with tuft of setae on ventromesial distal angles. Anterior lobe of sternite of 3rd pereopods subsemicircular to subrectangular, anterior margin with long setae. Fourth pereopods with propodal rasp consisting of several rows of corneous scales; preungual process apparently absent.

Males with 3 unpaired biramous pleopods; external rami well developed, internal rami rudimentary. Females with 4 unpaired pleopods;  $pl_2$ – $pl_4$  with both rami well developed,  $pl_5$  with external ramus well developed, internal ramus reduced. Telson with posterior lobes somewhat asymmetrical, separated by wide median cleft; terminal margins oblique, each with several moderately strong spines, interspersed with small spines; lateral margins each with corneous plate of fused denticles.

*Color*.—In living specimens, the carapace has brown and white spots; the anterior margin of the shield has three white patches interspersed with brown. Where the shield begins narrowing there is one large dark brown spot on each side. The posterior section of the carapace has a transverse row of five large white spots and more posteriorly, two moderately large orange spots. The anterior third of each branchiostegite is dark brown with white patches. The ocular peduncles are light yellowish-green with white chromatophores, more abundant on the distal half, and distally there is an incomplete blue ring. The corneae are brown. The ocular acicles have orange spots. The antennular peduncles are light yellowish-green with white chromatophores distally; the flagella are orange. The antennal peduncles are marked with white and brown bands; the flagella have blue and clear articles, most commonly in a sequence of three blue and one clear. The clear articles each have a distal white chromatophore. The maxillipeds have white and brown bands. The chelipeds are light brown with white spines and tubercles; the dactyls and fixed fingers are white on the distal halves and brown proximally, with orange mesial margins. The carpi and meri have dark brown patches. The pereopods have white and brown transverse bands, i.e., two brown bands on the proximal halves of the dactyls, one brown centrally on each propodus and carpus, and two brown bands on each merus. The abdomen, telson, and uropods are irregularly spotted with white, brown, blue, and red. All colors fade to white or straw in formalin or ethanol.

*Distribution*.—From northern Gulf of Mexico to Florida Keys, and from central eastern Florida to Puerto Rico; subtidal to 5 m.

*Etymology*.—This species is named for Dr. Patsy A. McLaughlin, in recognition of her work on the taxonomy and systematics of hermit crabs.

*Remarks*.—In his survey of the Crustacea Macrura and Anomura of Puerto Rico and the Virgin Islands, Schmitt (1935) identified four specimens as *Pagurus annulipes*. However, personal examination of these specimens has shown that two represent *P. macLaughlinae*. The other two specimens are in poor condition, but appear referable to the species subsequently described by Schmitt (1936) as *P. bonairensis*. Provenzano (1959) in his survey of hermit crabs from Florida also

mistakenly identified a common shallow-water species as *P. annulipes*, and was followed in this misidentification by Tabb and Manning (1961). Subsequently, Williams (1965) correctly described *P. annulipes* from North Carolina; however, he used the figure and color notes of Provenzano (1959) which did not apply to Stimpson's species. Forest and De Saint Laurent (1968) called attention to the discrepancies in the description of *P. annulipes* from Massachusetts and that of Provenzano's Florida material. Subsequently, Provenzano (in Rouse, 1970) commented that his original interpretation of *P. annulipes* had been incorrect, and referred his material to *P. bonairensis*. At that time Provenzano also suggested that quite possibly another undescribed species might exist that could have been confused with the latter species. Since then, *P. bonairensis* has been reported in Florida estuaries by several authors as the most abundant species of hermit crab (Voss et al., 1969; Hudson et al., 1970; Roessler et al., 1971; Bader and Roessler, 1971; Roessler et al., 1972; Tabb et al., 1972; Tabb et al., 1974; Roessler and Tabb, 1974; Roessler et al., 1975; Hooks et al., 1976).

During ecological studies of Card Sound, Florida (Brook et al., unpublished) it was noticed in freshly preserved specimens that two distinct color patterns existed in what had been presumed to be a single taxon. The majority of the specimens had banded pereopods as described by Provenzano (1959); however, a few had longitudinally striped pereopods. After examining the type specimens of *P. bonairensis* it was apparent that the majority of the specimens were not referable to Schmitt's taxon, but instead, represented an undescribed species. Thus the banded species, first identified as *P. annulipes* and subsequently as *P. bonairensis* by Provenzano and others, has been redescribed as *P. maccloughlinae*. The species with the longitudinally striped pereopods is, in fact, Schmitt's taxon.

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